

Maine CDC
Ambient Air Guidelines addendum



June, 2006

Prepared by:

Environmental and Occupational Health Program
Center for Disease Control and Prevention
Department of Human Services

Ambient Air Guidelines 2006 addendum

This addendum adds a new set of chemical-specific Ambient Air Guidelines to the list published in 2004 (Maine CDC 2004). According to protocol (Maine CDC 2004), AAGs are typically based on existing toxicity values. Where available, the appropriate value was selected from EPA IRIS database or CalEPA. For cancer risks the unit risk value, in units of incremental lifetime cancer risk (ILCR) per mg/m^3 , was selected. For noncancer risks the reference concentration (RfC, from IRIS) or reference exposure level (REL, from CalEPA), in units of mg/m^3 , was selected. If a suitable value was not available from either of these sources then a Threshold Limit Value (TLV) from the American Conference of Governmental Industrial Hygienists (ACGIH) was selected. RfCs and RELs could be used directly as AAGs. Unit risks and TLVs were converted to AAGs as outlined previously (Maine CDC 2004).

Table 1 lists the AAGs derived for this addendum. These are intended to supplement the list of AAGs previously published (Maine CDC 2004). Discussions of chemicals for which the derivation of an AAG was unusual are presented below.

1. Potential carcinogens

AAG derivations for three chemicals included an additional 10-fold uncertainty factor to account for potential carcinogenicity; this is consistent with the 2004 framework (Maine CDC 2004):

- **1,1-dichloroethylene** is an EPA class C carcinogen without an inhalation unit risk. Human evidence is described by EPA as ‘insufficient’ for purposes of quantifying risk, and the classification is based on increased kidney tumors in male mice (Maltoni et al. 1985). The International Agency for Research on Cancer (IARC) and the National Toxicology Program (NTP) have not classified this chemical.
- The carcinogenicity of **vinyl acetate** has not been assessed under IRIS. IARC (1995) classifies it as a 2B carcinogen and California has included it on the list of proposition 65 chemicals as a category II chemical. Human evidence is very limited and inconclusive. Studies in animals have shown increases in tumors of the nasal epithelium in rats exposed via inhalation. Vinyl acetate rapidly metabolizes to acetaldehyde and acetic acid in blood and tissue. The NTP has not classified vinyl acetate.
- The carcinogenicity of **vinyl bromide** has not been assessed under IRIS. IARC (1999) classifies vinyl bromide as a 2A carcinogen on the basis of liver tumors in rats and outcomes and metabolic pathways similar to those of vinyl chloride. The NTP classifies vinyl bromide as “reasonably anticipated to be a human carcinogen”.

Carcinogenicity for two trihalomethanes (**bromodichloromethane** and **dibromochloromethane**) is only assessed under IRIS for the oral exposure route. In these two cases the oral slope factor, in units of incremental lifetime cancer risk (ILCR) per mg/kg-d, was converted to an inhalation unit risk by dividing by 70 (kg body weight) and multiplying by 20 (m^3/d of inhaled air) to yield an ILCR per mg/m^3 . This type of conversion is overly simplistic but represented the best option available at this time.

2. CFC-113

CFC-113 is also known as Freon 113; the full name for this chemical is 1,1,2-trichloro-1,2,2-trifluoroethane (CASRN 76-13-1). There are no inhalation toxicity values for this chemical from the US EPA or CalEPA, so according to Maine CDC protocol the AAG is based on the ACGIH TLV-TWA of $7,670 \text{ mg}/\text{m}^3$. There is a small body of literature on the inhalation toxicity of CFC-113, and this is discussed briefly below.

As stated above, neither the US EPA nor CalEPA have derived inhalation toxicity values for CFC-113, despite the peculiar circumstance that both agencies have derived oral toxicity values based on inhalation studies. The IRIS RfD was derived from an occupational inhalation study of 50 workers exposed over an average of 2.8 years in which no toxic symptoms were observed at the highest level of exposure ($5,358 \text{ mg m}^{-3}$ (Imbus and Adkins 1972). An AAG based on this study would be $9.6 \text{ mg}/\text{m}^3$.

CalEPA derived a Public Health Goal for drinking water from an inhalation study in rats (CA EPA 1997)¹. This study found a significant increase in liver weights at $15,340 \text{ mg}/\text{m}^3$, and this concentration was considered to be a LOAEL. Body weight gain was significantly reduced at higher exposure levels. Dividing by 5.6 (5/7 days and 6/24 hours) converts this LOAEL to continuous exposure. An uncertainty factor of 300 was applied by CalEPA to account for interspecies variability, interindividual variability, and the use of a “mild” LOAEL. An AAG based on this study would be $9.2 \text{ mg}/\text{m}^3$.

The ACGIH TLV-TWA is $7,670 \text{ mg m}^{-3}$. Although several studies are mentioned in the ACGIH report, including the two mentioned above, the derivation of the TLV is not described (it is simply stated that this level will minimize the potential to systemic toxicity and cardiac sensitization). According to Maine CDC protocols, the AAG for CFC-113 is 18.3 mg m^{-3} based on the ACGIH TLV-TWA. This is within a factor of two of the values that could be derived from the inhalation studies described above.

¹ Du Pont (1985). Two year inhalation toxicity study with 1,1,2-trichloro-1,2,2-trifluoroethane in rats, Vol. 1. Medical Research Project Number 3683-001; Haskell Laboratory Report Number 488-84. (Unpublished report by E.I. Du Pont de Nemours and Co., issued March 5, 1985, as cited in CalEPA 1997).

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Table 1. Chronic Ambient Air Guidelines, June 2006²

Chemical	CASRN	AAG status	Conversion Factor (from		Chronic AAG (mg/m3)	Chronic AAG (ug/m3)	Toxicity Endpoint	Basis for AAG
			Chronic AAG (ppm)	ppm to mg/m3)				
acetaldehyde	75-07-0	final	2.E-03	1.90	5.E-03	5.E+00	C	IRIS unit risk (1991)
acetonitrile	75-05-8	final	4.E-02	1.70	6.E-02	6.E+01	NC	IRIS RfC/10 (1999)
acrolein	107-02-8	final	9.E-06	2.30	2.E-05	2.E-02	NC	IRIS RfC (2003)
acrylonitrile	107-13-1	final	2.E-05	2.17	3.E-05	3.E-02	C	OEHHA unit risk (2001)
allyl chloride	107-05-1	final	3.E-04	3.13	1.E-03	1.E+00	NC	IRIS RfC (1995)
benzyl chloride	100-44-7	final	4.E-05	5.26	2.E-04	2.E-01	C	OEHHA unit risk (2005) adjusted IRIS slope factor
bromodichloromethane	75-27-4	interim	8E-08	6.7	6.E-07	6.E-04	C	(1993)
bromoform	75-25-2	final	9.E-04	10.2	9.E-03	9.E+00	C	IRIS unit risk (1991)
carbon disulfide	75-15-0	final	2.E-01	3.1	7.E-01	7.E+02	NC	IRIS RfC (1995)
CFC-113	76-13-1	interim	2.E+00	7.67	2.E+01	2.E+04	NC	ACGIH TLV (1992)
CFC-114	76-14-2	interim	2.E+00	6.99	2.E+01	2.E+04	NC	ACGIH TLV (1991)
chlorobenzene	108-90-7	final	2.E-01	4.6	1.E+00	1.E+03	NC	OEHHA REL (2000)
chloroethane	75-00-3	final	4.E+00	2.64	1.E+01	1.E+04	NC	IRIS RfC (1991)
cyclohexane	110-82-7	final	2.E+00	3.4	6.E+00	6.E+03	NC	IRIS RfC (2003) adjusted IRIS slope factor
dibromochloromethane	124-48-1	interim	4.E-08	10.34	4.E-07	4.E-04	C	(1992)
dibromoethane, 1,2-	106-93-4	final	1.E-03	7.81	9.E-03	2.E-02	C	IRIS unit risk (2004)
dichlorobenzene, 1,4-	106-46-7	final	2.E-04	6.00	9.E-04	9.E-01	C	OEHHA unit risk (2005)
dichlorodifluoromethane	75-71-8	interim	2.E+00	4.95	1.E+01	1.E+04	NC	ACGIH TLV (1991)
dichloroethane, 1,1-	75-34-3	final	2.E-03	4.05	6.E-03	6.E+00	C	OEHHA unit risk (2005)

² According to Maine CDC convention, AAGs are marked as 'interim' when not derived from an US EPA (IRIS) or CalEPA inhalation toxicity value.
 Acronyms: IRIS- Integrated Risk Information System (US Environmental Protection Agency) <http://www.epa.gov/iris/>
 OEHHA- Office of Environmental Health Hazard Assessment (California Environmental Protection Agency) <http://www.oehha.ca.gov/index.html>
 ACGIH- American Council of Governmental Industrial Hygienists <http://www.acgih.org/home.htm>

Table 1. Chronic Ambient Air Guidelines, June 2006 (continued)

Chemical	CASRN	AAG status	Conversion Factor (from		Chronic AAG (mg/m3)	Chronic AAG (ug/m3)	Toxicity Endpoint	Basis for AAG
			Chronic AAG (ppm)	ppm to mg/m3)				
dichloroethylene, 1,1-	75-35-4	final	5.E-03	3.97	2.E-02	2.E+01	NC	IRIS RfC/10 (2002)
dichloroethylene, trans-1,2-	156-60-5	interim	5.E-01	3.97	2.E+00	2.E+03	NC	ACGIH TLV (1991)
dichloropropane, 1,2-	78-87-5	final	9.E-04	4.62	4.E-03	4.E+00	NC	IRIS RfC (1991)
dichloropropene, 1,3-	542-75-6	final	6.E-04	4.54	3.E-03	3.E+00	C	IRIS unit risk (2000)
ethanol	64-17-5	interim	2.E+00	1.9	5.E+00	5.E+03	NC	ACGIH TLV (1991)
heptane (n-Heptane)	142-82-5	interim	1.E+00	4.1	4.E+00	4.E+03	NC	ACGIH TLV (1992)
hexachlorobutadiene	87-68-3	final	4.E-05	10.7	5.E-04	5.E-01	C	IRIS unit risk (1991)
hexane (n-Hexane)	110-54-3	final	2.E-01	3.52	7.E-01	7.E+02	NC	IRIS RfC (2005)
hexanone, 2-	591-78-6	interim	1.E-02	4.00	5.E-02	5.E+01	NC	ACGIH TLV (1991)
methyl bromide (bromomethane)	74-83-9	final	1.E-03	3.89	5.E-03	5.E+00	NC	IRIS RfC (1992)
methyl-t-butyl ether (MTBE)	1634-04-4	final	1.E-02	3.6	4.E-02	4.E+01	C	OEHHA unit risk (2005)
propylene	115-07-1	final	2.E+00	1.72	3.E+00	3.E+03	NC	OEHHA REL (2002)
tetrachloroethane, 1,1,2,2-	79-34-5	final	3.E-05	6.87	2.E-04	2.E-01	C	IRIS unit risk (1994)
trichlorobenzene, 1,2,4-	120-82-1	interim	1.E-02	7.40	9.E-02	9.E+01	NC	ACGIH TLV (1992)
trichloroethane, 1,1,2-	79-00-5	final	1.E-04	5.56	6.E-04	6.E-01	C	IRIS unit risk (1994)
trichlorofluoromethane	75-69-4	interim	3.E-05	5.62	1.E+01	1.E+04	NC	ACGIH TLV (1992)
	95-63-6,							
trimethylbenzene (1,2,4- and 1,3,5-)	108-67-8	interim	6.E-02	4.92	3.E-01	3.E+02	NC	ACGIH TLV (1992)
vanadium	7440-62-2	interim		not avail.	1.E-04	1.E-01	NC	ACGIH TLV (1992)
vinyl acetate	108-05-4	final	6.E-03	3.52	2.E-02	2.E+01	NC	IRIS RfC/10 (1990)
vinyl bromide	593-60-2	final	7.E-05	4.37	3.E-04	3.E-01	NC	IRIS RfC/10 (1994)